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Novel device for rifle sights

Aircraft countermeasure against missiles

Robotic arm for mine clearance

Extra protection for combat suits

Waving, not drowning

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Australian Government
Department of Defence
Defence Science and
Technology Organisation

The Defence Science and Technology Organisation (DSTO) is part of the Department of Defence and provides scientific advice and support to the Australian Defence Organisation. DSTO is headed by the Australian Chief Defence Scientist, Dr Roger Lough, and employs about 2100 staff, including some 1300 researchers and engineers. It is one of the two largest research and development organisations in Australia.

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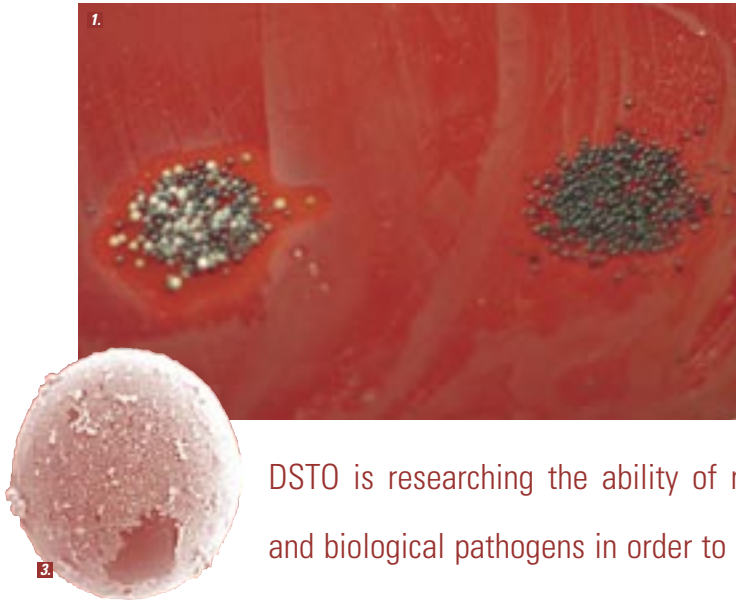
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Extra protection for combat suits



DSTO is researching the ability of modified activated carbons to counter toxic chemicals and biological pathogens in order to increase the level of protection offered by combat suits against chemical and biological warfare agents.

Activated carbon spheres are already incorporated into the new generation, stand alone, one-piece Chemical Biological Combat Suits (CBCS) currently in use within the Australian Defence Force.

The synthetic carbon spheres layered between the inner and outer shells of these garments have a very high capacity to adsorb hazardous agents and thereby reduce the risk of contact with the skin. The activated carbons bind to their surface any hazardous chemical and biological agents that permeate through the outer fabric, but cannot destroy them.

The aim of the current research being carried out by Dr George Favas and Dr David Proll is to enhance the protective capability of the carbon spheres by infusing their surfaces with reactive nano-sized catalysts, which provide self-decontamination protection against chemical warfare agents and also kill harmful biological agents.

Enhancing the breakdown reactions

Dr Favas explains that “impregnating the surfaces of the activated carbons with the reactive nano-sized particles is thought to significantly increase the rate of breakdown of hazardous agents.”

“We believe that the two major influences affecting the self-decontamination and biocidal properties of the carbon spheres are the size of the reactive particles on the surface of the carbon combined with its large surface area.”

“Preliminary experiments using scanning electron microscopy have shown the size of the reactive particles to be in the nano size region. Furthermore, surface area studies of activated carbons modified with the nano particles have shown that they still maintain their very high adsorptive capacity,” he says.

In another series of studies, the antibacterial properties of these new carbons have been assessed against a test bacterium *Escherichia coli* (*E. coli*) with very encouraging results. After placing only a very small quantity of reactive chemical on the surface of the carbon, the biocidal effect on *E. coli* was significantly enhanced by several orders in magnitude.

Towards better and broader protection

The next steps of the program involve assessing the impact of these carbons on other bacterial species, and studying the effect of integrating various blends of reactive chemicals into the carbons to enhance their biocidal properties.

Research will also be carried out to measure the speed of the self-decontamination process upon exposure to chemical warfare agents.

It is expected that these new modified carbons will be eventually integrated into the next generation of protective Nuclear Biological Chemical (NBC) clothing.

1. Bacteria suppressing capabilities of activated carbon spheres: on left without nano carbon particles, on right with nano particles.

2. David Proll and George Favas holding a sample of combat suit fabric with activated carbon protection.

3. Electron microscope view of activated carbon sphere.

Viewing device on target to reduce frontline risk

In urban warfare operations, bullet or fragment wounds to the head or face are proportionally higher than wounds to other parts of the body. To help prevent such injuries, DSTO has developed a new capability for rifle sights that reduces the vulnerability of soldiers to enemy fire.

OAVD a commercialisation success for DSTO

DSTO has been marketing the OAVD technology through its Business and Commercialisation Office (BCO). Marcus Belder, Technology Commercialisation Manager at the DSTO Edinburgh BCO, undertook to establish a route to the global market for the device by identifying which companies could provide best market access through their existing sales activities.

Swedish company, Aimpoint, originator of the red dot rifle sighting technology, was seen to be the prime candidate, having achieved sales of its military scope in the order of hundreds of thousands over the last couple of years, in addition to which, the ADF has been successfully using the OAVD as an attachment to the Aimpoint Scope.

Through negotiations conducted in London and Las Vegas, Aimpoint now has a global licence for OAVD. The company has since engaged in promoting the device to all of its major customers, and is seeking quotes from Australian manufacturers to produce it.



1. Australian soldiers using the Periscope Rifle in the trenches at Gallipoli.

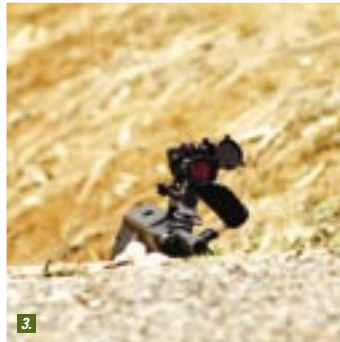


2.

2. ADF soldier with Steyr rifle fitted with OAVD.

3. Exposure to enemy fire using OAVD.

4. Exposure without using OAVD.



3.



4.

A long-held dream of countless generations of soldiers - to be able to shoot without being seen - is now a reality. The DSTO-developed Off Axis Viewing Device (OAVD) is a small arms attachment that integrates with the weapon's sighting system, enabling the soldier to scan and engage targets around corners and over walls without physically exposing himself.

Needing only to present the very small target of the rifle to enemy fire, the OAVD provides the soldier with a normal scope view of the scene at 50 degrees to the axis of the rifle sight.

According to DSTO researcher Tom Chapman, "The OAVD has some similarity to the Periscope Rifle from the trenches of Quinn's Post at Gallipoli. Unlike the cumbersome wooden frame of that early example of Anzac ingenuity, this device is compact, light and enables users to maintain the tempo of modern army operations."

"Most importantly, it has been designed in such a way as to not impede the normal operation of small arms rifles. The device can be carried on the soldier's webbing or on the weapon and rotated to use on a basis of need."

The OAVD is a further addition to the range of auxiliary equipment available for the modern assault rifle, such as torches and grenade launchers, that enable the soldier to individually configure a weapon to suit the specific mission task in hand.

While the other 'toolkit' components provide various kinds of offensive capabilities, the OAVD is primarily directed at enhancing soldier survivability and providing the ability to safely return fire.

Human factors considerations paramount

A key feature of the system design is simplicity of use. Chapman explains, "In the high-pressure environment of the battlefield, a soldier requires technology that is intuitive to operate and is robust and reliable in all conditions. Human factors considerations were a strong focus of the design and development of the system."

Earlier sighting systems that enabled around-the-corner viewing used cameras and were tethered to the soldier. These systems, however, were reliant on battery power and suffered from poor accuracy.

Moreover, soldiers were using weak muscle groups to support the weapon, resulting in a typically unstable posture that made it difficult to 'get off' a well-aimed shot.

The OAVD, by comparison, allows the soldier to place the butt of the rifle in the crook of the elbow, triangulating the position of the rifle to the body, thereby providing a stable posture from which to engage targets. The rifle can be operated solely with the non-master hand if necessary.

The system also has the advantages of requiring minimal training to operate, and the OAVD attachment can be rapidly dismounted or rotated out of the way for normal weapon operation.

OAVD usability

The OAVD capability offers a particular advantage in urban operational environments like the cities of Iraq in conditions where soldiers need to scan unsurveyed areas of threat and return fire when suppressed by enemy fire.

This capability, used together with recently introduced advanced body armour, will provide ADF troops in these operational scenarios with some of the highest levels of protection attainable.

The OAVD, like the periscope rifle, is notable also as being a wholly Australian innovation – the only one of such in the currently available range of small arms equipment. Manufacturing of initial quantities for the ADF has been managed by the Defence Materiel Organisation and produced by BAE Systems.

Waving, not drowning

A DSTO-developed wave modelling capability, delivered recently to the Navy's Directorate of Oceanography and Meteorology (METOC), takes the bump out of amphibious operations.

Knowledge of wave and surf conditions at a particular time and location is crucial to the success of amphibious operations. DSTO has developed a software package that gives Navy the ability to make decisions not only about the choice of beach landing site, but also the optimum landing time frame and choice of craft so that casualties for craft and personnel are minimised.

DSTO researcher Georgette Christie, who carried out much of the work on the most recent phase of the project, explains why knowledge of landing conditions is so important.

"The preferred breaker wave-type for amphibious operations is spilling waves, found on gently sloping beaches. Plunging breakers usually occur on steeper beach gradients and result in a forceful, rapid release of energy, making landings difficult and dangerous. Where the beach is extremely steep, surging breakers hit the beach as a wall of water that makes a landing difficult to impossible."

"Not only is the type of breaking wave important but also the breaker height and angle. If the breaker height is too high, the wave may break on the stern of a landing craft as it lands or withdraws from the beach and swamp it. The breaker angle is important as well because waves or long shore currents arising from the waves may push the craft off-course to the wrong site, or may cause a craft to broach as it approaches the shore or become grounded," she says.

According to Les Hamilton, senior researcher for the project, "Substantial gains can be obtained by improved knowledge of environmental conditions. For beaches where landings are possible, operational research analyses by the US Navy have indicated that improved decisions on ingress and egress locations and on timing allowed by accurately forecast current and wave fields can lead to an increase of 15% combat power put ashore, an increase of 75% in the time period for full force operations, and a 20% reduction in high risk time when extracting the force."

The DSTO package devised to assist in the planning process consists of a research tool known as Simulating WAVes Nearshore (SWAN) which has been coupled with another wave modelling application, the US Navy Standard Surf Model (known as SURF). Used together, they can predict the wave and surf conditions prevalent for a particular area of inshore sea or surf zone, based on information for wind and tide along with bathymetry and topography fields.

The impact of surf zone width

Large surf zone widths – the distance from the coastal edge of the water to the furthest point out to sea where the waves first start to break – can have a negative effect on amphibious operations.

When waves enter water where the depth is less than half their wavelength, their wavelength decreases while wave height increases; when the wave height to water depth ratio becomes greater than 0.78, the wave breaks.

The number of surf lines (waves) in the surf zone can be calculated as a ratio of surf zone width to dominant wavelength.

The SWAN component

The SWAN application is a publicly available wave forecasting model developed by the Delft University of Technology, Netherlands. Code and manuals for the model are freely downloadable from the University's website. The model is regularly upgraded, and has undergone substantial international testing.

Widely regarded as the new standard for near-shore wave modelling, SWAN uses time-series data on wind, tide, and current conditions to compute a range of wave parameters for a two-dimensional region of ocean, particularly for small-scale shallow water coastal areas.

SWAN encompasses a number of wave propagation processes such as refraction and shoaling, mild slope diffraction, and blocking and reflections by opposing currents and the presence of obstacles.

Generation and dissipation processes are also accounted for, including wave generation by local winds, dissipation by bottom friction, depth-induced wave breaking, 'white-capping', and wave-wave interactions.



The SURF component

SURF was developed for the US Navy in the late 1980s, and has since been embedded in US Navy operational systems such as the Tactical Environment Support System (TESS). It was developed specifically to model conditions in the surf zone, and outputs a number of key parameters for this area not calculated by SWAN, but as single point of time calculations only.

Also unlike SWAN, SURF carries out computations for just a one-dimensional view of the sea along a chosen line from inshore waters to shore, yet provides a very useful depiction of the surf zone since wave breaking action is largely determined by local depth.

SURF calculates wave energy, and from this, predicts wave heights from the outer surf zone to beach along with the percentage of breaking wave types (spilling, plunging, and surging), wavelength, breaker angle and the longshore current. It also calculates the surf zone width and number of surf lines.

SURF combines this information into a number known as the Modified Surf Index (MSI). The higher the MSI, the rougher the environment.

The data required to run SURF includes a depth profile, a directional wave spectrum, and wave refraction information.

The two models combined

Describing the design of DSTO's package, Christie explains, "These two models are linked by converting the SURF model to a subroutine from within the SWAN model, providing a time series of inshore and surf zone conditions."

"A graphical user interface (GUI) has been added to make the model easy to operate in terms of data entry and setup of input data files, and to display the results in graphical formats that are easily interpreted and understood. The GUI includes scaleable displays of RAN Hydrographic Office bathymetry charts and world coastlines, and the area of interest may be interactively selected," she says.

The GUI shields users from the complex technical and formatting decisions required by SWAN, changing SWAN from a research tool to an operational application. The application is PC-based and fully stand-alone, so that it can be run on laptops at sea or ashore. Users need only input the basic familiar parameters of wind, sea state, and tidal height.

Regional scale Australian and global topography and bathymetry files are seamlessly attached to the model as input sources, but detailed local depth data are required for accurate forecasts for particular areas.

Algorithms from the US Navy's *Joint Surf Manual* have been added to provide stoplight 'go', 'caution' and 'no-go' indicators for various landing craft.

The present package is an outgrowth of a concept demonstrator developed to investigate the feasibility of local area wave forecasting by RAN units in the field. Inclusion of chart displays has been funded by RAN METOC Services, which is also funding conversion of the present package to a full geographic information systems (GIS) application using the Environmental Systems Research Institute (ESRI) ArcGIS framework.

The package is to undergo field testing during amphibious trials later this year.

Above: Georgette Christie and Les Hamilton gathering field data with radio transmitter buoy to test wave modelling application.

Robotic arm lends a hand in mine clearance



Over the past two years, a team of DSTO scientists, engineers and operational analysts have been studying ways to safely neutralise landmines which continue to pose a major threat to the local populace in many developing countries. Because of the high risk personnel are exposed to during mine clearance by traditional means, the research focus has been on the development of unmanned robotic systems.

The team, comprising Dr Brian Jarvis, Dr Kym Ide, Paul Munger and Leong Yen, have constructed a simulation laboratory with a stretch of road that typifies the conditions of land mine deployment, used to develop and test control algorithms for a robotic arm.

The simulated road can be easily reconfigured with pot holes, bumps, mounds and sloping ground of varying severity as required.

The aim for the researchers was to find a way of using robotic apparatus for tasks where conditions are invariably different – quite unlike conventional robotic operations in a known or structured environment, such as a car assembly line, where the robot always knows the location of everything within its 'reach envelope'.

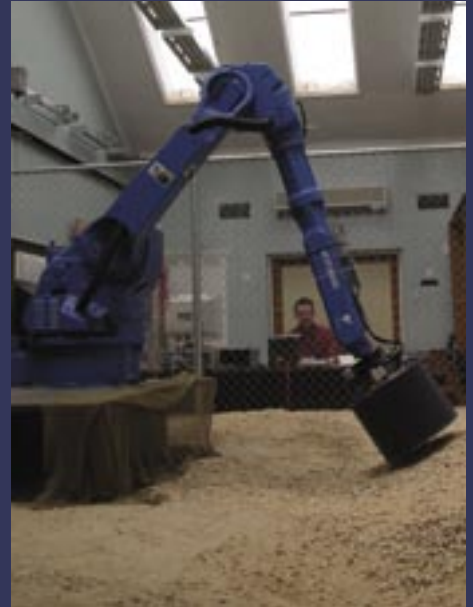
Robotics in the field

Dr Jarvis explains, "We set out to solve the problem of how to teach a robot to autonomously place a remotely detonated shaped-charge munition, known as a 'Whacker', onto the ground directly above a buried landmine. A large part of the challenge was that the task had to be achieved regardless of how rough or undulating the ground was."

The robot was fitted with an infrared sensor mounted on the gripper at the end of its arm to give it a range finding capability, and special feeler sensors were also developed for its gripper to enable the robot to sense when the Whacker makes contact with the ground.

Supplied with this sensor information, the robot control system can detect any irregularities in ground slope due to a pot hole or bump,

Robotic arm being trialled on simulated road in DSTO laboratory.



and correspondingly tilts the Whacker so that its base contacts the ground uniformly, thereby ensuring that the charge does not slide off target when released.

"Our trials have demonstrated that we can precisely place a Whacker onto the ground at any position with the robot's reach to within a few millimetres of accuracy," says Dr Jarvis.

A quicker and safer process

The upshot of these achievements is to make the work of mine clearance operators much safer and more efficient.

Mines are firstly located by a landmine detection vehicle that marks their ground position with a paint spot.


The robotic arm, mounted on the front of a vehicle, is driven to the site by operators stationed at a safe distance using a wireless ground control station with video link vision to guide the vehicle. When the vehicle is at the required location, an operator then simply points a mouse cursor on the monitor screen at the paint spot on the ground to select the target point for the robotic arm and initiates the automated process of delivering the Whacker charge.

After the charge has been placed and the robot moved to safety, the explosive charge is detonated to neutralise the mine using 'Swarmfire', a wireless technology jointly developed by DSTO and Australian Defence Industries Pty Ltd for the detonation of munitions at distances of up to three kilometres.

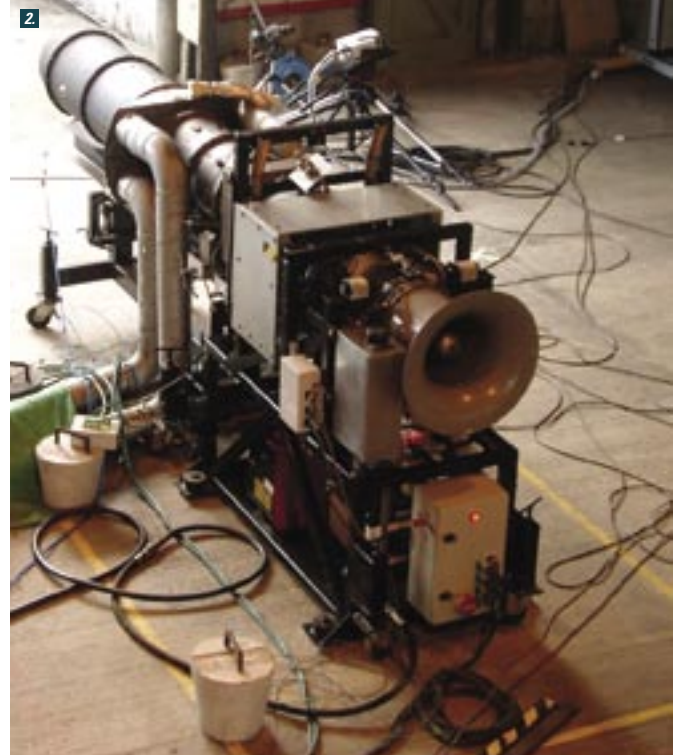
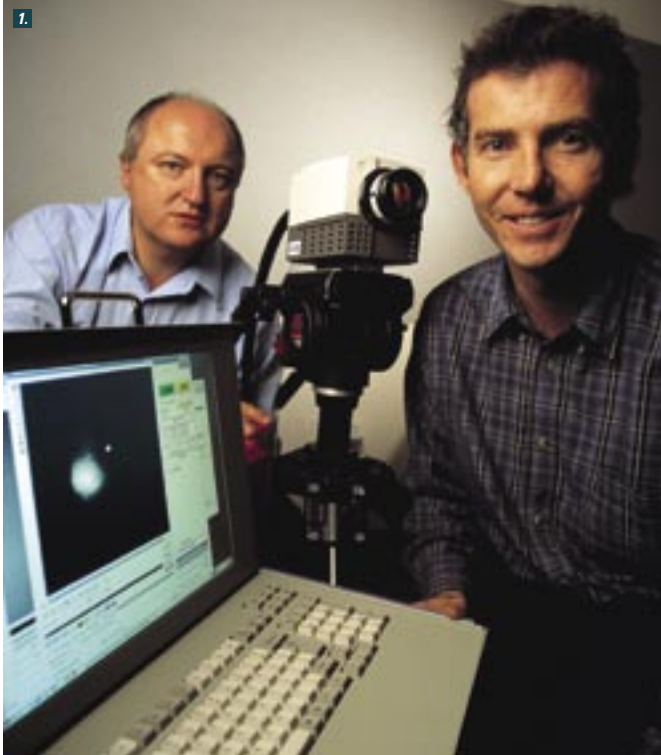
Every day, land mines kill and maim scores of people worldwide. As well as posing a threat to ADF personnel on some deployments overseas, they impede the delivery of humanitarian aid and the recovery of war ravaged countries, and directly add to the burden of already devastated communities by creating new orphans and mine impact survivors with horrific injuries long after the conflict is over.

Dr Brian Jarvis, DSTO researcher.

Aircraft countermeasure **against missile attack**

A fighter jet, likely an F-35, is shown in profile, flying towards the right. It is positioned in front of a large, bright, circular explosion or fireball that fills much of the background. The jet's nose is pointed towards the viewer, and its wings and tail are visible. The explosion behind it is a mix of bright yellow and orange, with some darker, smoky edges. The overall scene suggests a high-speed maneuver or a defensive action against a missile threat.

A Defence scholarship is facilitating studies on laser propagation to achieve a more effective countermeasure against missile threats.



In recent years, military and civilian aircraft worldwide have become increasingly vulnerable to attack by man-portable shoulder-launched missiles, most of which use infrared (IR) sensors that home in on target hot spots. The most promising new airborne defence capability is a laser-based system known as a Directed IR Counter Measure (DIRCM), but its performance in the exhaust plume zone has not been properly studied. DSTO and the UK's Defence Science and Technology Laboratory (Dstl) are carrying out research to further understand how exhaust heat, turbulence and plume constituents affect laser beam propagation.

The most vulnerable times for aircraft from IR guided missile attack are during take-off and landing, being situations when the aircraft and crew are operating at high levels of intensity, and the aircraft is also closest to the ground.

The traditional defence against such missiles has been to fire off volleys of flares, which present alternative infrared targets that divert the missile away from the aircraft. This form of countermeasure is not ideal because it involves carrying hazardous pyrotechnic devices on board, the numbers available are finite, and deployment is not always effective.

The advent of the DIRCM system has provided another method for protecting aircraft from IR missile attack. This system decisively overcomes the first two of the problems mentioned, and is also highly effective.

When an IR missile is detected, the DIRCM tracks it and fires a modulated beam of IR laser energy at the missile's sensor, confusing the missile's guidance system and effectively blinding it. Such a system, NEMESIS from the US company Northrop Grumman, is being fitted to the Airborne Early Warning & Control Wedgetail aircraft and also to the new air-to-air refuellers which will carry two on each aircraft.

Laser beam propagation

But DIRCM is not the complete answer. As DSTO researcher William Isterling explains, "One potential deficiency of the system is degradation of the laser beam over its propagation path."

"Little is known about the effect on the laser beam when transmitting through a hot engine exhaust plume. This is of particular importance during take-off as the DIRCM may be required to operate through a largely plume obscured area when protecting the aircraft from a forward aspect missile attack."

Recent studies have been examining the effect of factors such as temperature, turbulence, and exhaust gas constituents.

Some preliminary testing undertaken in the UK by the Dstl in collaboration with DSTO indicated that there may be significant problems with beam wander, and hence, tracking accuracy.

Current findings on propagation

A more detailed investigation was conducted in April this year at a joint DSTO-Dstl trial in the UK led by Dr Laurence Cox (Dstl) and Dr Miro Dubovinsky (DSTO). One of the major outcomes of the trial was the collection of data to be used to validate a digital computer model of laser beam transmission.

This model, being developed by DSTO in collaboration with Dstl and the University of Adelaide, will provide an assessment of laser beam wander and spread for various engine types for given parameters such as flow rate, temperature and exhaust gas constituent concentrations.

The eventual outcome of the research will be obscuration maps for particular engine types that operatives of electronic warfare countermeasures can use to help decide whether to opt for a flare launch instead of DIRCM in the case of a plume-obscured missile attack.

The research was facilitated by the Defence Secretary's Scholarship awarded to William Isterling in 2004 to carry out studies on laser propagation.

1. Dr Miro Dubovinsky and William Isterling with infrared imaging camera used in DIRCM study.
2. DIRCM testbed facilities at the Defence Science and Technology Laboratory in UK.

The human dimension of future warfighting

As a concept, Network Centric Warfare (NCW) holds the promise of greatly enhancing military force capabilities, but the reality of applying the methodology across all Services and in coalition environments is proving to be far from straightforward. DSTO is conducting research on the problems that the Australian Defence Force (ADF) personnel encounter when undertaking missions with other force elements within the ADF and beyond.



The research team included DSTO personnel Dr Leoni Warne, Irena Ali and Derek Bopping, consultants Dr Dennis Hart of the Australian National University and Celina Pascoe of the University of Canberra.

Dr Warne describes the core concerns of the work. "Operations in a NCW environment often necessitate interaction between force elements with little or no history of cooperation, so trust plays an important role as an antecedent to information management, sharing and exchange, and correspondingly, on the decisions made as a result of these processes."

"Furthermore, trust plays a central role in how issues of information overload and integrity are resolved, and this will influence the way decisions are made in the fog of war. It is possible that the development of these concepts may have implications for ADF organisational structures, and training and education initiatives."

The inquiry process

As one line of inquiry, the team has been carrying out interviews on issues of communication and trust with personnel in all three Services, across a range of levels of service, and for both genders with those who participated in NCW environments in East Timor, Afghanistan and Iraq.

Greater emphasis has been given to the findings of interviews with those who have served in Iraq, this being the most recent operation and, arguably, the closest of these to the concept of NCW in practice.

The responses gathered ranged over topics such as training and preparation before deployment; duties during deployment; issues associated with decision-making during high tempo operations; command and control processes; levels of interdependence with Services, coalition members and other agencies; communication flows and channels; and lessons learned.

Another line of inquiry uses small-scale simulation exercises involving personnel with no prior experience of each other to examine the impact on information sharing, joint decision-making, and other cooperative behaviours in conditions of uncertainty. According to Dr Warne, several common threads have emerged from this work.



Above: Irena Ali and Dr Leoni Warne.

Other photos: ADF personnel on deployment in Iraq.



The understandings gained

"Effective cooperation entails successful communication and trust between the involved elements. If either or both of these are missing to a significant degree, then the potential for cooperation is inhibited at best and destroyed at worst," she stresses.

The analysis she offers proposes that the concepts, language and terminology used to describe the respective worldviews of the potential partners may differ to such a degree that one may simply be unable to grasp the intended meaning or significance of what is shared by the other. The problem can arise not only because of national cultural differences but also because of the specialised understandings of a particular armed service or unit within a national force.

"Meanwhile, issues like information overload, tempo, source reliability, richness of the communication medium (or lack of it), and irrelevant or conflicting information simply add to the difficulties encountered by the potentially cooperating partners," she says.

"Even when the capability to communicate successfully is present, if trust in either the information itself or its source is absent, then whatever communication may in fact occur is less likely to lead to effective cooperation. The level of trust (or mistrust) can affect not only the amount of communication but, probably even more importantly, what is communicated, how it is communicated, and the effects the communication is designed to have."

In order to develop trust, she sees that the process of developing relationships, ideally in a face-to-face situation and an informal context outside of the direct work environment, is vitally important. Interestingly, evidence has come to hand that such trust building exercises have been happening in Iraq, despite the often hostile and dangerous environment.

This body of understandings is being added to with information currently being collected in a series of more extensive interviews. The team intends to test its findings by conducting a larger scale simulation exercise at some later stage.

Some comments from the NCW survey responses

"The manner in which (they were) looking to use that system, it was at times difficult to know if I was being ordered to do something or if it was just general conversation."

"If we didn't have the rapport that we built, they wouldn't have given us a particular information system to work off and [we would] have had no information."

"I very quickly learnt that you can trust the information, but you can't trust analysis, or whatever analysis there was, and I very quickly learnt that you couldn't trust the reporting."

"So, you know, that was one of my biggest bugbears ... there was no really useable database. I had to develop my own database over there just to store my information and to be able to see it."

World leading success in multi-band satellite communications

DSTO and CSIRO have developed an antenna technology that enables simultaneous access to different frequency bands of satellite transmissions, greatly expanding the information transfer and situational awareness capabilities available to military users.

DSTO researcher Peter Kerr explains, “ADF communications are transmitted via the Optus C1 satellite, using transponders in two different frequency bands – X-band and Ka-band. The new antenna technology enables multi-band communications by providing simultaneous access to more than one satellite transponder in both bands.”

“This allows the Australian Defence Force, for example, to access command and control on X-band at the same time as high data rate broadcast on Ka-band. It also allows satellite planners greater flexibility to dynamically configure the satellite network to better meet operational needs.”

While X-band (7 - 8 GHz) has been in use by numerous Defence forces since the 1970s, use of Ka-band (20 - 30 GHz) is relatively new. The Australian developed technology, using both X and Ka bands, is believed to be the first of its kind anywhere in the world.

Genesis of the new system

Multi-band feeds have already been in use for some time on large antennas, like those applied to radio astronomy and deep space mission tasks.

The capability being developed for Defence was aimed at providing the same functionality in much smaller antennas, enabling the rapid deployment of such units to remote areas in support of operations.

CSIRO, which has been involved in building many of the larger systems, was included on the project to assist with the development of a compact, high-performance, low-cost, radio frequency (RF) technology suitable for military satellite communications applications.

DSTO developed the satellite earth terminal in partnership with several communications technology vendors, including EM Solutions in Brisbane which provided custom X-band and Ka-band equipment. CISCO (Adelaide) supported the final phase of the project, supplying much of the internet protocol (IP) telephony and router infrastructure used to demonstrate the terminal technology.



Multi-band satellite communications earth terminal.

The technology on show

The technology was recently demonstrated to senior Defence personnel, DSTO and CSIRO scientists and industry representatives at the CSIRO ICT Centre in Sydney.

The multi-band terminal successfully demonstrated an ability to provide a range of communications to remotely located military personnel, including Voice over IP (VoIP), file transfer, IP video and video conferencing, and showcased the extra benefits available when earth terminals are capable of accessing X-band and Ka-band satellite transponders simultaneously. A novel application featured was the provision of IP-quality service while using a number of communications channels at different frequencies and in different frequency bands.

Another improvement in capability relates to signal loss during heavy thunderstorms. The higher frequency Ka-band tends to fade under these conditions, but by using processes known as IP routing and traffic prioritisation, the data can be dynamically routed to the more stable lower frequency X-band without loss of data.

This technology is equally applicable for commercial purposes where dual band satellites are in use.

Greater collaboration for ASC and DSTO



DSTO and ASC Pty Ltd (formerly known as Australian Submarine Corporation) have negotiated an agreement to improve submarine-related technology and innovation.

The three-year industry alliance agreement was signed recently by Chief Defence Scientist Dr Roger Lough, and ASC Managing Director Greg Tunny, in the presence of the Secretary of Defence Mr Ric Smith.

The agreement will create greater collaboration for the development of innovative submarine-related technologies, and moves the two organisations into a more strategic partnership.

It will initially focus on technology innovations in the areas of noise and vibration, hull and structural integrity, enabling technologies, asset management and systems sciences, including systems and sensor integration for the Collins Class submarines.

Above: Front - Chief Defence Scientist Roger Lough and ASC Managing Director Greg Tunny. Rear - Secretary of Defence Ric Smith and ASC GM Commercial/Legal Tony Kuhlmann.

Top right: IBM Defence Account Executive Geoff James, IBM National GM for Defence Ernest Garner, Director DSTO's Information Sciences Laboratory Neil Bryans, and Director DSTO's Systems Sciences Laboratory Nanda Nandagopal.

Centre of Expertise for study of Autonomous and Uninhabited Vehicles

DSTO and The University of Sydney's Australian Centre for Field Robotics (ACFR) have established a Centre of Expertise (COE) in Defence Autonomous and Uninhabited Vehicle Systems.

The new COE will focus on the development and application of Uninhabited Vehicle Systems for defence applications.

The agreement is an extension of existing collaboration between DSTO and ACFR, which have worked together for about a year on unmanned systems within the framework of DSTO's Automation of the Battlespace Initiative (ABSI).

This new COE will allow DSTO and the ACFR to extend their R&D collaboration in autonomous and uninhabited systems, and will exploit leading edge technologies to address strategic challenges such as Australia's ageing population, the war on terror, reducing cost of operations and force transformation.

Under the COE arrangements, a broad range of projects will be undertaken with a primary focus on multi-vehicle systems and the integration of uninhabited air, ground, and underwater vehicle systems.

DSTO and IBM sign industry alliance



Research into Network Centric Warfare, one of the major thrusts of modern defence science, is a key aspect of an industry alliance agreement signed between DSTO and IBM.

The primary objective of the alliance is to combine IBM's research expertise in information technology with that of DSTO in defence science and technology.

Chief Defence Scientist Dr Roger Lough highlighted the complementary nature of the work being done by both IBM and DSTO. "The research that IBM and DSTO will be able to conduct as a partnership will allow us to further DSTO's role as an independent and impartial advisor to the Department of Defence," he said.

According to Ernest Garner, General Manager Defence, IBM (Australia/New Zealand), "This alliance will let both organisations increase innovation by fostering a skills exchange. Our ultimate aim is to better serve the Australian Department of Defence. IBM has extensive research capabilities, and coupling these with the knowledge of DSTO will allow us to further refine the systems currently running Australia's Defence Force."

As well as studies on network centric warfare, the organisations will jointly conduct research and develop solutions in various capability areas including geospatial intelligence environments, information-management and dissemination-architecture, command and control systems and quantum and high-performance computing.

C A L E N D A R

12 - 14 July 2005	2005 Safeguarding Australia Conference: The 4th Homeland Security Summit and Exposition Conference National Convention Centre, Canberra, ACT http://www.safeguardingaustraliaconference.org.au/
14 July 2005	Science, Engineering & Technology (SET) Summit on Counter-Terrorism Technology National Convention Centre Canberra, ACT http://www.safeguardingaustraliasummit.org.au
3 - 4 Aug 2005	Science Corporate Information Systems TecXpo 2005 DSTO Edinburgh, South Australia Email: tecxpo@dsto.defence.gov.au
22 - 25 Aug 2005	8th International Symposium on Signal Processing and its Applications Sydney, Australia Tel +61 2 4221 3065 http://www.elec.uow.edu.au/isspa2005
4 - 8 Sep 2005	2005 European Signal Processing Conference Antalya, Turkey http://www.eusipco2005.org/
20 - 21 Sep 2005	Unmanned Systems National Museum of Australia, Canberra, ACT http://www.iqpc.com.au/
25 - 29 Sep 2005	31st European Conference on Optical Communications Scottish Exhibition Conference Centre, Glasgow, UK http://conferences.iee.org/ecoc05/index.html
4 - 7 Oct 2005	Land Warfare Conference Gold Coast Convention & Exhibition Centre Broadbeach, Queensland Tel +61 8 8259 5455 Fax +61 8 8259 5196 Email: lwcc@dsto.defence.gov.au
31 Oct - 2 Nov 2005	Communications, Internet and Information Technology Cambridge, USA Email: calgary@iasted.org
14 - 16 Nov 2005	Human-Computer Interaction Phoenix, Arizona, USA Email: calgary@iasted.org
5 - 8 Dec 2005	2nd Australian Conference on Artificial Life University of Technology, Sydney, NSW http://www.itee.adfa.edu.au/~abbass/acal05/